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Indian Standard

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(पहला पुनरीक्षण)

Elastomer Insulated Flexible Cables for Use in Mines — Specification

(First Revision)

ICS 29.060.20; 73

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Power Cables Sectional Committee, ETD 09

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

The standard was originally published in 1998 as a single standard for mining cables, superseding IS 691 : 1984 and IS 1026:1984. The first revision of this has been undertaken to update it with the present manufacturing practices and to review it with the applicable changes, if any, as per the current regulations related to flexible cables for use in mines. In this revision following major changes have been made:

a) The requirement of insulation has been modified for power core, pilot and earth cores.
b) The requirement of tensile strength and elongation for armour wire have been specified.
c) Application of insulation for pilot core has been included.
d) The colour scheme and number scheme for identification of cables has been modified.
e) The requirement of dielectric power sector has been changed.
f) The status of referred standards have been updated.

The relevant Central Electricity Authority (CEA) regulations or Directorate General of Mines Safety (DGMS) regulations may include additional provisions concerning the use of cables in mines The user should satisfy himself that these rules; in particular rules for additional precautions to be adopted in mines, are complied with when using these cables.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ELASTOMER INSULATED FLEXIBLE CABLES FOR USE IN MINES — SPECIFICATION

(First Revision)

SECTION 1 GENERAL

1 SCOPE

The standard covers the requirements of flexible cables of the following voltage grades for use in coal mines, quarries and other miscellaneous mines:

1.1, 3.3, 3.8/6.6 and 6.35/11 kV

NOTES

1 1.1 kV and 3.3 kV voltage grade cables are suitable for both earthed and unearthed system.

2 3.8/6.6 kV voltage grade cables are suitable for 6.6 kV earthed system.

3 6.35/11 kV voltage grade cables are suitable for 11 kV earthed system and 6.6 kV unearthed system (6.6/6.6 kV).

4 The cables conforming to this standard may be operated at a power frequency voltage 10 percent higher than the cable rated voltage.

These cables are suitable for use where the combination of ambient temperature and temperature-rise due to load results in conductor temperature not exceeding 90°C under normal operation and 250°C under short circuit conditions.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 1885 (Part 32) shall apply.

3.1 Routine Tests — Tests made by the manufacturer on all finished cable lengths to demonstrate the integrity of the cable.

3.2 Type Tests — Tests required to be made before supply on a general commercial basis on a type of cable in order to demonstrate satisfactory performance characteristics to meet the intended application.

NOTE — These tests are of such a nature that after they have been made they need not be repeated unless changes are made in the cable materials or design which might change the performance characteristics.

3.3 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.4 Earthed System — An electric system, which fulfils the following conditions:

a) Neutral-point or the mid-point connection is earthed in such a manner that, even under fault conditions, the maximum voltage that can occur between any conductor and the earth does not exceed 80 percent of the nominal system voltage;

b) The neutral-point or the mid-point connection is not earthed but a protective device is installed which automatically cuts out any part of the system which accidently becomes earthed within a duration of 1 m; or

c) In case of ac systems only, the neutral-point is earthed through an arc suppression coil with arrangement for isolation within one hour of occurrence of the fault for the non-radial field cables and within 8 h for radial cables, provided that the total of such periods does not exceed 125 h.

NOTE — It should be realized that in a system where an earth fault is not automatically and promptly isolated, the extra stresses on the insulation of cables during the earth fault reduce the life of the cables to a certain degree. If the system is expected to be operated fairly often with a permanent earth fault, it may be advisable to classify the system in next higher voltage category.

3.5 Unearthed System

An electrical system, which does not fulfil the requirements of the earthed system (*see* **3.4**).

3.6 Protective Screen

The metallic part of the screen, which is intended to carry the earth fault current.

SECTION 2 MATERIALS

4 CONDUCTOR

The conductor shall be of annealed tinned copper complying with IS 8130.

5 INSULATION

Insulation shall be of elastomeric compound conforming to following types of IS 6380

5.1 Power Cores

a) Type IE2: For voltage grades up to and including 1.1 kV; and
b) Type IE3: For voltage grades above 1.1 kV

5.2 Pilot and Earth Cores

a) Type IE2; and
b) Use of semi-conducting covering is also permissible for earth cores.

6 SEMI-CONDUCTING COMPOUND

The semi-conducting compound shall be elastomeric and suitable for the operating temperature of the cable both during sustained operation and during short circuit.

7 TAPE

7.1 Proofed Tape

The proofed tape shall be of closely woven textile without selvedge, proofed on one side with rubber. The thickness of tape shall be approx. 0.15 mm.

7.2 Polyethylene Terephalate (PETP) or Polypropylene Base Tape

The thickness of the tape shall be between 0.01 mm to 0.05 mm.

7.3 Any other suitable tape based on glass, textile, composite or other synthetic material.

8 CENTRE

The centre shall consist of elastomeric compound or fibrous material suitable for the operating temperature of the cable.

9 FILLERS

9.1 The fillers shall consist of jute or similar roving, rubber compounds, including regenerated and unvulcanised rubber, or polymeric compounds. The fillers at the manufacturer’s discretion may form an integral part of the sheath.

9.2 The filler material shall be suitable for operating temperature of cable.

10 CRADLE SEPARATOR

Unless specified otherwise, the cradle separator shall consist of elastomeric compound and shall be suitable for the operating temperature of cable.

11 ARMOUR

11.1 Armour shall consist of strands of galvanized steel wires. The individual steel wire shall conform to IS 3975.

11.2 The wires taken from the finished cable shall meet following requirements.

a) The tensile strength of steel wire shall be not less than 250 N/mm^2 and not more than 580 N/mm^2.
b) The elongation at break shall be not less than 6 percent.
c) Steel wires shall meet torsion test requirements as per IS 3975.
d) The uniformity of zinc coating shall conform to IS 3975, subject to reduction of 30 s dip in specified number of dips.
e) The mass of zinc coating shall be not less than 95 percent of the mass specified in Table 2 of IS 4826.

12 SHEATH

12.1 Inner Sheath

The inner sheath shall consist of elastomeric compound conforming to Type SE3 of IS 6380. The semi-conducting inner sheath, where specified, shall be as per **6**.

12.2 Outer Sheath

The outer sheath shall be of elastomeric compound conforming to Type SE4 of IS 6380.

13 REINFORCEMENT MATERIAL

13.1 Tape

Tapes shall be according to **7.1**.

13.2 Cord/Yarns

Cord/yarns wherever used for reinforcement shall be of cotton or synthetic material.

NOTE — The material used in the cable shall have no deleterious effect on the other components of the cable.

SECTION 3 CONSTRUCTION

14 CONDUCTOR

14.1 The conductor shall be flexible and shall conform to class 5 of IS 8130.

14.2 The size of power conductor, earth conductor and pilot conductor, as applicable, shall be as per table of the respective cable type.

14.3 It is permissible to split the earth conductor into equal parts and to place them in the interstices. The earth conductors shall be bare or covered as specified for the respective cable type.

14.4 Suitable separator may be applied over the conductor for cables rated voltage up to 6.6 kV (E), at the discretion of the manufacturer

15 CONDUCTOR SCREENING

The power cores of all cables having rated voltage above 6.6 kV (E) shall have conductor screen. It shall consist of extruded semi-conducting compound, which may be applied on the top of a semi-conducting tape.

Conductor screening is not required for pilot and earth core (s).

16 INSULATION

16.1 The conductor (with or without separator/ conductor screen) shall be provided with elastomeric insulation.

16.2 Thickness of Insulation

The Nominal thickness of insulation shall be as per table of respective cable type.

Unless specified otherwise, the thickness of covering for earth conductor shall be at the discretion of the manufacturer.

16.3 Tolerance on Insulation Thickness

The average thickness of insulation shall not be less than the specified nominal value (t_i).

The smallest of the measured values of thickness shall not fall below the specified nominal value (t_i) by more than 0.1 mm + 0.1 t_i.

NOTE — Thickness of any separator or semi-conducting screen shall not be included in the thickness of insulation.

16.4 Application of Insulation

The insulation shall be so applied that it fits closely on the conductor (with or without separator/conductor screen) but shall not adhere to it. The insulation shall be applied by extrusion.

When pilot core is required to be build up, it is permissible either to use higher insulation thickness or to provide an additional layer of insulation/sheath material.

16.5 A tape may be provided over the insulation, at the discretion of the manufacturer, for cables not having insulation screen.

17 INSULATION SCREEN

17.1 The power cores of all cables having rated voltage above 6.6 kV (E) shall have insulation screen. It shall consist of a non-metallic semi-conducting part and a metallic part.

17.2 The non-metallic part shall be applied directly over the insulation. It shall consist of extruded semi-conducting compound. A layer of semi-conducting tape may be applied over extruded layer.

17.3 The metallic part shall be of annealed tinned copper wires of diameter not exceeding 0.51 mm and shall be applied either spirally or in the form of braid over the non-metallic part. Use of non-metallic cord or other similar material is permissible along with the metallic screen.

17.4 For cables subjected to repeated flexing in service (for example, reeling unreeling duty), it is permissible to apply insulation screen consisting of extruded semi-conducting screen alone. In such cases the insulation screen shall meet the electrical test as per Annex E.

18 PROTECTIVE SCREEN

The protective screen shall be applied individually or collectively as specified in cable construction.

The protective screen shall be of annealed tinned copper wires of diameter not exceeding 0.51 mm and shall be applied either spirally or in the form of braid. Use of non-metallic cord or other similar material is permissible in the protective screen.

NOTE — A separator tape may be provided under protective screen at the discretion of the manufacturer.

19 CONDUCTANCE OF SCREEN

The metallic screen / protective screen, wherever applied, shall meet the following conductance requirements

19.1 Individual Core Screen

The conductance of each screen shall not be less than 25 percent of that of the main conductor. However, the combined dc resistance of all screens at 20°C shall not be more than 1.15 milliohms per metre.

19.2 Collective Screen

The conductance shall not be less than 50 percent of that of the main conductor. However, the d.c. resistance of screen at 20°C shall not be more than 1.15 milliohms per metre.

20 CORE IDENTIFICATION

20.1 Except specified otherwise, the cores shall be identified by any of the following means:

a) By coloured / numbered tape;
b) By number printing on the cores;
c) By coloured insulation for voltage rating up to 6.6 kV (E), that is, 3.8/6.6 kV; and
d) By coloured yarn in composite braid over cores.

20.2 Colour Scheme for Identification

Following colour scheme shall be followed to identify the cores:

a) **2 Cores :** Power core — Red and earth core — Green

b) **3 Cores :** Power core — Red, pilot core — Black and earth core — Green

c) **4 Cores :** Power cores — Red, yellow, blue and covered earth core(s) — Green

d) **5 Cores :** Power cores — Red, yellow, blue; covered earth core — Green and pilot core — Black

NOTE — Colour of earth cores(s) with semi-conducting covering shall be black.

20.3 Scheme for Identification by Numbering

Numbers 1, 2 and 3, shall identify power cores, pilot core(s) shall be identified by number **4** and covered earth core(s) shall be identified by number **0**. The numbers shall be applied at regular intervals and the consecutive numbers shall be inverted in relation to each other. A dash shall be placed underneath each numeral.

In case of identification by number printing on the cores, the numbers shall be repeated at max. 50 mm interval.

In case of identification by numbered tape, the numbers in tape shall be repeated at max. 150 mm interval.

21 LAYING UP OF CORES

21.1 The cores shall be laid up with right hand lay. The lay length shall be as under, unless specified otherwise.

a) Up to 25 mm^2 : Max. 15 times the Pitch circle diameter (PCD); and

b) Above 25 mm^2 : Max. 18 times the Pitch circle diameter (PCD).

21.2 When cores are required to be laid around cradle separator, it shall be such that the radial distance between the cores is *min*. 1.8 mm, unless specified otherwise.

21.3 The laid up assembly shall be reasonably circular. The interstices may be filled with suitable fillers. A suitable binder over laid up assembly is also permissible.

21.4 There shall be no undue restraint on the relative movements of cores when the cable is subjected to repeated movements.

22 INNER SHEATH

22.1 The inner sheath, wherever required, shall be applied over laid up cores by extrusion. It shall fit closely over laid up assembly and can be removed without damaging the insulation.

22.2 Thickness of Inner Sheath

The thickness of inner sheath shall not be less than the value specified in table of respective cable type.

22.3 A suitable separator may be provided over inner sheath.

23 ARMOURING

23.1 The armouring shall be provided over inner sheath and shall be as close as practicable. Each strand shall consist of seven wires. The lay length of armour shall not be more than six times the pitch circle diameter.

23.2 The direction of lay of armour shall be left hand and that of individual strand shall be right hand.

23.3 The conductance of the armour shall not be less than 50 percent of that of the power core. Substitution of galvanised steel wire with annealed tinned copper wires is permissible in the armour.

23.4 A suitable binder may be applied over the armour.

24 OUTER SHEATH

24.1 The outer sheath shall be applied by extrusion over laid up assembly/protective screen/ inner sheath/ armour as specified in the cable construction.

24.2 Thickness of Outer Sheath

The nominal thickness of outer sheath shall be as specified in table of respective cable type.

24.3 Tolerance on Thickness of Outer Sheath

The average thickness of outer sheath shall not be less than the specified nominal value (t_s).

The smallest of the measured values of thickness shall not fall below the nominal value (t_s) by more than 0.2 mm + 0.2 t_s.

NOTE — Wherever permitted in cable construction, outer sheath may be reinforced with non-metallic material in the form of tape or braid.

24.4 The colour of outer sheath shall be black or as agreed between purchaser and manufacturer.

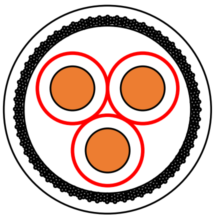
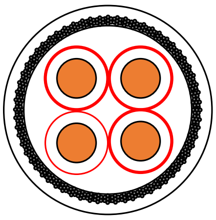
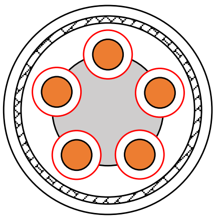
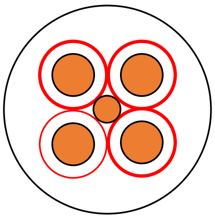
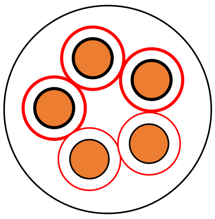
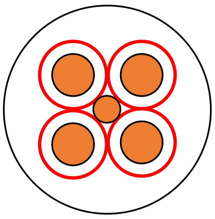
NOTE — A longitudinal strip/line in contrast colour on the outer sheath is permissible to identify any twist in the cable as per agreement between the purchaser and supplier.

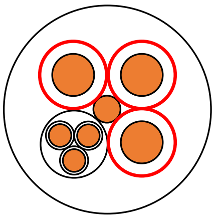
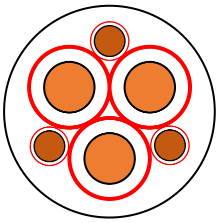
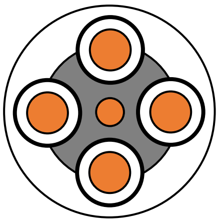
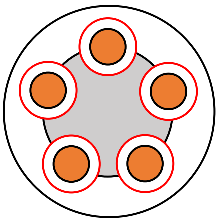
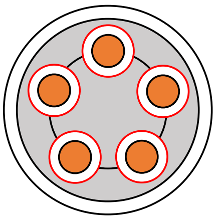
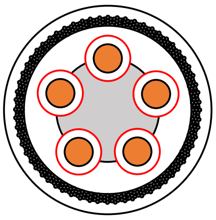
25 CABLE CONSTRUCTION AND DIMENSIONS

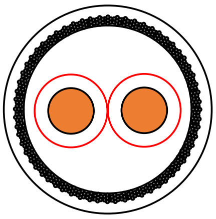
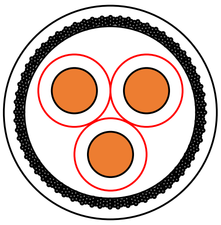
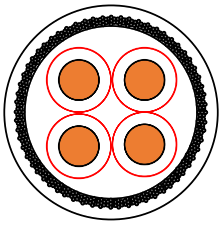
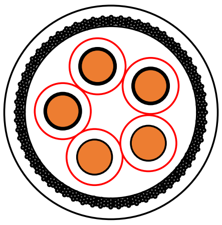
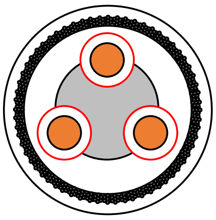
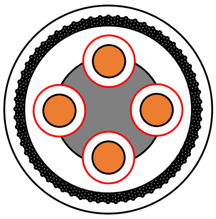
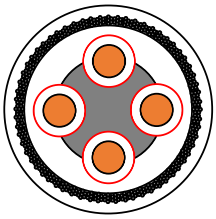
25.1 Construction details of various types of cable covered in this standard are given in Table 1 and dimensional details have been specified in the subsequent tables based on Annex B to Annex D. The overall diameter of cables specified in respective tables are only for guidance and these have to be mutually agreed between the supplier and purchaser.

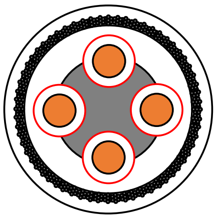
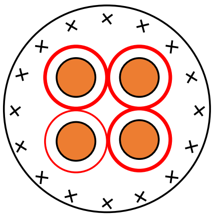
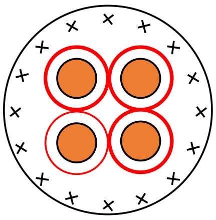
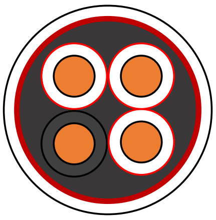
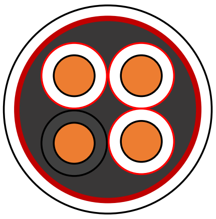
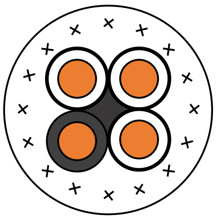
Table 1 Construction of Cables

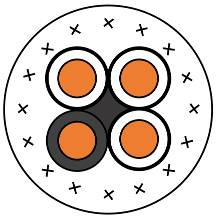
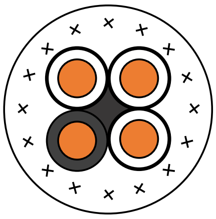
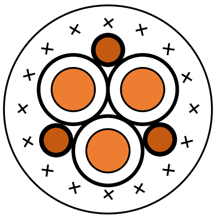
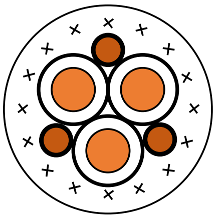
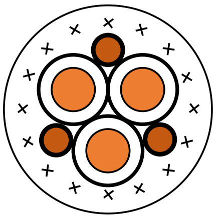
(*Clause* 25.1)

Cable Type	Voltage Grade kV	Construction	Sectional Diagram
FT1	1.1	3-core. Three metallic screened cores laid around centre, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 2	
FT2	1.1	4-core. Three metallic screened power cores and one unscreened earth core laid around centre, inner sheathed, Pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 3	
FT3	1.1	5-core. Three power cores and one earth core and one pilot core laid around cradle separator, inner sheathed, protective metallic screened and outer sheathed. Dimensions: Table 4	
FT4(S)	1.1	5-core. Three metallic screened power cores and one unscreened pilot core laid around a bare earth conductor and sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Reinforcement is permissible in the outer sheath. Dimensions: Table 5	
FT6(S)	1.1	5-core. Three metallic screened power cores, one unscreened pilot core and one unscreened earth core laid around centre and sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Reinforcement is permissible in the outer sheath. Dimensions: Table 6	
FT7	1.1	5-core. Three metallic screened power cores and one metallic screened pilot core laid around bare earth conductor and sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Reinforcement is permissible in the outer sheath. Dimensions: Table 7	

Cable Type	Voltage Grade kV	Construction	Sectional Diagram
FT7(S)	1.1	7-core. Three metallic screened power cores and one unscreened elastomeric covered pilot unit containing three pilot cores laid around bare earth conductor and sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. The elastomeric covering of pilot unit shall be black and shall conform to **13.1**. Pilot cores shall be identified as P1, P2 and P3. Suitable binder may be provided under elastomeric covering of pilot unit. Reinforcement is permissible in the outer sheath. Dimensions: Table 8	
FT8	1.1	6-core. Three metallic screened power cores laid around centre with one unscreened pilot core and two elastomeric or semi-conducting covered earth conductors placed in the outer interstice and sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Reinforcement is permissible in the outer sheath. Note: Elastomeric covered earth conductors shall be identified by Green colour or by number 0. Dimensions: Table 9	
FT10	1.1	5-core. Three power cores and one pilot core each individually screened with semi-conducting elastomeric compound, laid around a semi-conducting elastomeric cradle separator containing a bare earth conductor and sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 10	
FTD3	1.1	5-core. Three power cores, an earth core and a pilot core are laid around an elastomeric cradle separator, with lay length max. 10 times pitch circle diameter, and sheathed. Min. distance between the adjacent cores shall be 1.0 mm Dimensions: Table 11	
FTD3(S)	1.1	5-core. Three power cores, an earth core and a pilot core are laid around a semi-conducting cradle separator, with lay length max. 10 times pitch circle diameter, extruded semi-conducting inner sheathed and elastomeric outer sheathed. Dimensions: Table 12	
P3	1.1	5-core. Three power cores, one earth core and one pilot core laid around an elastomeric cradle separator, inner sheathed, pliable armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 13	

Cable Type	Voltage Grade kV	Construction	Sectional Diagram
PLC2	1.1	2-core. Two cores laid up together, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 14	
PLC3	1.1	3-core. Three cores laid up together, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 14	
PLC4	1.1	4-core. Three power cores and an earth core laid up together, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 14	
PLC5	1.1	5-core. Three power cores, an earth core and a pilot core laid up together, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 14	
PA3	1.1	3-core. Three cores laid around an elastomeric cradle separator, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 15	
PA1	1.1	4-core. Three power cores and an earth core laid around an elastomeric cradle separator, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 16	
3PA1	3.3	4-core. Three power cores and an earth core laid around an elastomeric cradle separator, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 17	

Cable Type	Voltage Grade kV	Construction	Sectional Diagram
6PA1	3.8/6.6	4-core. Three power cores and an earth core laid around an elastomeric cradle separator, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 18	
3FTS	3.3	4-core. Three power cores individually metallic screened and one unscreened earth core laid around centre and non-metallic reinforced outer sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Dimensions: Table 19	
6FTS	3.8/6.6	4-core. Three power cores individually metallic screened and one unscreened earth core laid around centre and non-metallic reinforced outer sheathed. The metallic screen shall be in the form of composite braid incorporating synthetic cord / yarn. Dimensions: Table 20	
3FTCS	3.3	4-core. Three insulated power cores and one semi-conducting elastomeric covered earth conductor laid around a semi-conductive elastomeric centre, semi-conductive elastomeric inner sheathed, optional semi-conducting taped, collectively metallic screened and outer sheathed. NOTE — If identification tape is used to identify earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conductive inner sheath. Dimensions: Table 21	
6FTCS	3.8/6.6	4-core. Three insulated power cores and one semi-conducting elastomeric covered earth conductor laid around a semi-conductive elastomeric centre, semi-conductive elastomeric inner sheathed, optional semi-conducting taped, collectively metallic screened and outer sheathed. NOTE — If identification tape is used to identify earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conductive inner sheath. Dimensions: Table 22	
3FTINS	3.3	4-core. Three power cores individually screened with semi-conducting elastomeric compound and an earth conductor covered with semi-conducting elastomeric compound laid around semi-conducting elastomeric centre and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. Dimensions: Table 23	

Cable Type	Voltage Grade kV	Construction	Sectional Diagram
6FTINS	3.8/6.6	4-core. Three power cores individually screened with semi-conducting elastomeric compound and an earth conductor covered with semi-conducting elastomeric compound laid around semi-conducting elastomeric centre and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. Dimensions: Table 24	
11FTINS	6.35/11	4-core. Three power cores (without metallic screen) and an earth conductor covered with semi-conducting elastomeric compound laid around semi-conducting elastomeric centre and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. Dimensions: Table 25	
3FTINS/3	3.3	6-core. Three power cores individually screened with semi-conducting elastomeric compound and earth conductor, split into three, covered with semi-conducting elastomeric compound, laid up together with earth conductors placed in outer interstices and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. All split up earth conductors shall have same colour/number for core identification. Dimensions: Table 26	
6FTINS/3	3.8/6.6	6-core. Three power cores individually screened with semi-conducting elastomeric compound and earth conductor, split into three, covered with semi-conducting elastomeric compound, laid up together with earth conductors placed in outer interstices and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. All split up earth conductors shall have same colour/number for core identification. Dimensions: Table 27	
11FTINS/3	6.35/11	6-core. Three power cores (without metallic screen) and earth conductor, split into three, covered with semi-conducting elastomeric compound, laid up together with earth conductors placed in outer interstices and non-metallic reinforced outer sheathed. NOTE — If identification tape is used to identify power cores and earth conductor, it shall be applied with suitable gap to maintain the electrical continuity of earth conductor with the semi-conducting layers of power cores. All split up earth conductors shall have same colour/number for core identification. Dimensions: Table 28	

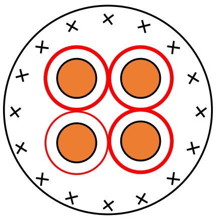
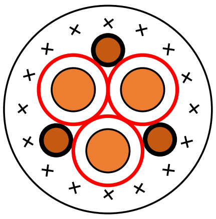
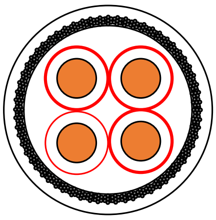
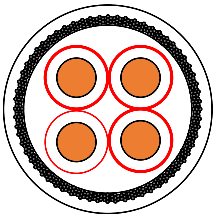
Cable Type	Voltage Grade kV	Construction	Sectional Diagram
11LL	6.35/11	4 core. Three power cores individually metallic screened and earth conductor with elastomeric/semi-conducting covering, laid up around centre and non-metallic reinforced outer sheathed. NOTE — If identification tape is used for core identification over conducting/semi-conducting layer, it shall be applied with suitable gap to maintain the electrical continuity of conducting/semi-conducting layer of power/earth core. Dimensions: Table 29	
11LL/3	6.35/11	6 Core. Three power cores individually metallic screened and earth conductor, split into three, covered with elastomeric covering or semi-conducting elastomeric compound, laid up together with earth conductor placed in the outer interstices and non-metallic reinforced outer sheathed. NOTE — If identification tape is used for core identification over conducting/semi-conducting layer, it shall be applied with suitable gap to maintain the electrical continuity of conducting/semi-conducting layer of power/earth core. All split up earth conductors shall have same colour/number for core identification. Dimensions: Table 30	
3PA1(S)	3.3	4-core. Three metallic screened power cores and an unscreened elastomeric covered earth core laid around centre, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 31	
6PA1(S)	3.8/6.6	4-core. Three metallic screened power cores and an unscreened elastomeric covered earth core laid around centre, inner sheathed, pliable wire armoured and outer sheathed. Reinforcement is permissible in the outer sheath. Dimensions: Table 32	

Table 2 Cable Type FT1

(*Clause* 25.1, *Table* 1)

Nominal Conductor Area (mm^2)	Thickness of Insulation (Nominal) (mm)	Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand (No./mm)	Approx. Overall Diameter (mm)
		Inner (Min.) (mm)	Outer (Nom.) (mm)		
25	1.4	2.4	4.5	7/0.70	43.5
35	1.4	2.6	5.0	7/0.70	48.5
50	1.6	2.6	5.0	7/0.90	54.0
70	1.6	3.0	5.7	7/0.90	60.0
95	1.8	3.0	5.7	7/0.90	65.0
120	1.8	3.0	6.4	7/0.90	69.5

Table 3 Cable Type FT2

(*Clause* 25.1, *Table* 1)

Nominal Conductor Area		Thickness of Insulation (Nom)		Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand	Approx. Overall Diameter
Power	Earth	Power	Earth[#]	Inner (Min.)	Outer (Nom.)		
(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)	(No/mm)	(mm)
25	16	1.4	1.2	2.6	5.0	7/0.70	48.0
35	16	1.4	1.2	2.6	5.0	7/0.70	51.5
50	25	1.6	1.4	2.6	5.7	7/0.90	59.5
70	35	1.6	1.4	3.0	5.7	7/0.90	64.5
95	50	1.8	1.6	3.5	6.4	7/0.90	72.0
120	70	1.8	1.6	3.5	6.4	7/1.25	78.0

[#] The diameter of earth core shall be built up equal to nominal diameter of screened power core.

Table 4 Cable Type FT3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness			Sheath Thickness		Approx. Overall Diameter
Power	Earth	Pilot	Power	Earth	Pilot[#]	Inner (Min.)	Outer (Nom.)	
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
16	16	16	1.2	1.2	1.2	2.2	4.5	44.5
25	25	16	1.4	1.4	1.2	2.4	4.5	49.5
35	35	16	1.4	1.4	1.2	2.6	5.0	54.5
50	50	25	1.6	1.6	1.4	2.6	5.0	60.0
70	70	35	1.6	1.6	1.4	3.0	5.7	67.0
95	95	50	1.8	1.8	1.6	3.5	6.4	75.5

[#] The diameter of screened pilot core shall be built up equal to nominal diameter of power core.

Table 5 Cable Type FT4(S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness		Nominal Sheath Thickness	Approx. Overall Diameter
Power	Earth	Pilot	Power	Pilot #		
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)
16	16	16	1.2	1.2	5.2	38.0
25	16	16	1.4	1.2	5.6	41.0
35	16	16	1.4	1.2	5.6	44.0
50	25	25	1.6	1.4	5.6	49.5
70	35	35	1.6	1.4	6.4	57.0
95	50	50	1.8	1.6	7.2	65.0

[#] The diameter of pilot core shall be built up equal to nominal diameter of screened power core.

Table 6 Cable Type FT6(S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			**Nominal Insulation Thickness**			**Nominal Sheath Thickness**	**Approx. Overall Diameter**
Power	Earth	Pilot	Power	Earth [#]	Pilot [#]		
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)
16	16	16	1.2	1.2	1.2	5.2	38.5
25	25	16	1.4	1.4	1.2	5.6	44.0
35	35	16	1.4	1.4	1.2	5.6	47.5
50	50	25	1.6	1.6	1.4	6.4	55.0
70	70	35	1.6	1.6	1.4	7.2	63.0
95	95	50	1.8	1.8	1.6	7.2	69.5

[#] The diameter of Pilot core & Earth core shall be built up equal to nominal diameter of screened power core.

Table 7 Cable Type FT7

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			**Nominal Insulation Thickness**		**Nominal Sheath Thickness**	**Approx. Overall Diameter**
Power	Earth	Pilot	Power	Pilot		
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)
16	16	16	1.2	1.2	5.2	38.0
25	16	25	1.4	1.4	5.6	41.0
35	16	35	1.4	1.4	5.6	44.0
50	25	50	1.6	1.6	5.6	49.5
70	35	70	1.6	1.6	6.4	57.0
95	50	95	1.8	1.8	7.2	65.0

Table 8 Cable Type FT7 (S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			**Nominal Insulation Thickness**		**Nominal Sheath Thickness**	**Approx. Overall Diameter**
Power	Earth	Pilot	Power	Pilot [#]		
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)
25	16	2.5	1.4	1.0	5.6	41.0
35	16	2.5	1.4	1.0	5.6	44.0
50	25	4	1.6	1.0	5.6	49.5
70	35	6	1.6	1.0	6.4	57.0
95	50	6	1.8	1.0	7.2	65.0
120	70	10	1.8	1.2	7.2	70.5

[#] The diameter of pilot unit shall be built up equal to nominal diameter of screened power core.

Table 9 Cable Type FT8

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness		Nominal Sheath Thickness	Approx. Overall Diameter
Power	Earth	Pilot	Power	Pilot / Earth		
(mm²)	(mm²)	(mm²)	(mm)	(mm)	(mm)	(mm)
25	10	10	1.4	1.2	5.2	39.0
35	10	10	1.4	1.2	5.6	41.5
50	16	16	1.6	1.2	5.6	46.5
70	25	25	1.6	1.4	6.4	54.5
95	35	35	1.8	1.4	6.4	60.0

Table 10 Cable Type FT10

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness		Nominal Sheath Thickness	Approx. Overall Diameter
Power	Earth	Pilot	Power	Pilot		
(mm²)	(mm²)	(mm²)	(mm)	(mm)	(mm)	(mm)
25	16	16	1.4	1.2	5.6	44.5
35	16	16	1.4	1.2	5.6	47.5
50	25	25	1.6	1.4	6.4	54.5
70	35	35	1.6	1.4	6.4	58.5
95	50	50	1.8	1.6	7.2	65.5

NOTES

1 The diameter of screened pilot core shall be built up equal to nominal diameter of screened power core.

2 Approx. thickness of semi-conducting screen shall be 1.0 mm.

Table 11 Cable Type FTD3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness			Nominal Sheath Thickness	Approx. Overall Diameter
Power	Earth	Pilot	Power	Pilot	Earth		
(mm²)	(mm²)	(mm²)	(mm)	(mm)	(mm)	(mm)	(mm)
6	6	6	0.9	0.9	0.9	3.0	26

NOTE — Use of Type FTD3 cable is restricted only up to 250 V (a.c.).

Table 12 Cable Type FTD3(S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Insulation Thickness			Sheath Thickness		Approx. Overall Diameter
Power	Earth	Pilot	Power	Pilot	Earth	Inner (Nom.)	Outer (Nom.)	
(mm²)	(mm²)	(mm²)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
6	6	6	0.9	0.9	0.9	1.5	2.5	28.5

NOTE — Use of Type FTD3(S) cable is restricted only up to 250 V (ac).

Table 13 Cable Type P3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor			Nominal Thickness of Insulation			Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand	Approx. Overall Diameter
Power	Pilot	Earth	Power	Pilot [#]	Earth	Inner (Min.)	Outer (Nom.)		
(mm^2)	(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)	(No./mm)	(mm)
6	6	6	1.0	1.0	1.0	2.0	3.6	7/0.45	35.5
10	10	10	1.2	1.2	1.2	2.2	4.5	7/0.7	43.0
16	16	16	1.2	1.2	1.2	2.2	4.5	7/0.7	46.5
25	16	25	1.4	1.2	1.4	2.4	4.5	7/0.7	51.5
35	16	35	1.4	1.2	1.4	2.6	5.0	7/0.7	56.5
50	25	50	1.6	1.4	1.6	2.6	5.7	7/0.9	65.0
70	35	70	1.6	1.4	1.6	3.0	5.7	7/0.9	70.5
95	50	95	1.8	1.6	1.8	3.5	6.4	7/0.9	79.0

[#] The diameter of pilot core shall be built up equal to nominal diameter of power core.

Table 14 Cable Type PLC 2, PLC 3, PLC 4 and PLC 5

(*Clause* 25.1, *Table* 1)

Cable Type	No. of Cores	Nominal Area of Conductor	Nominal Thickness of Insulation	Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand	Approx. Overall Diameter
		(Power/Pilot/ Earth)	(Power/Pilot/ Earth)	Inner (Min.)	Outer (Nom.)		
		(mm^2)	(mm)	(mm)	(mm)	(No./mm)	(mm)
PLC 2	2	4	1.0	1.6	3.2	7/0.45	23.0
PLC 3	3	4	1.0	1.6	3.2	7/0.45	24.0
PLC 4	4	4	1.0	1.8	3.2	7/0.45	25.5
PLC 5	5	4	1.0	1.8	3.2	7/0.45	27.0

Table 15 Cable Type PA3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor	Nominal Thickness of Insulation	Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand	Approx. Overall Diameter
(Power/Earth)	(Power/Earth)	Inner (Min.)	Outer (Nom.)		
(mm^2)	(mm)	(mm)	(mm)	(No/mm)	(mm)
6	1.0	1.8	3.6	7/0.45	31.0
10	1.2	2.0	3.6	7/0.45	34.5
16	1.2	2.0	4.0	7/0.45	38.5
25	1.4	2.2	4.5	7/0.7	45.0
35	1.4	2.4	4.5	7/0.7	48.0
50	1.6	2.6	5.0	7/0.7	54.5
70	1.6	2.6	5.0	7/0.9	59.0
95	1.8	3.0	5.7	7/0.9	66.0
120	1.8	3.0	5.7	7/0.9	69.5
150	2.0	3.0	6.4	7/0.9	76.0
185	2.2	3.5	6.4	7/1.25	84.0

Table 16 Cable Type PA1

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**No./Nominal Diameter of Wires in Steel Strand** (No./mm)	**Approx. Overall Diameter** (mm)
6	1.0	2.0	3.6	7/0.45	33.5
10	1.2	2.0	4.0	7/0.45	37.5
16	1.2	2.2	4.5	7/0.7	43.5
25	1.4	2.4	4.5	7/0.7	48.0
35	1.4	2.4	4.5	7/0.7	51.5
50	1.6	2.6	5.0	7/0.9	59.0
70	1.6	3.0	5.7	7/0.9	65.5
95	1.8	3.0	5.7	7/0.9	71.0
120	1.8	3.0	6.4	7/0.9	76.0
150	2.0	3.5	7.1	7/1.25	86.0
185	2.2	4.0	7.1	7/1.25	92.5

Table 17 Cable Type 3PA1

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**No./Nominal Diameter of Wires in Steel Strand** (No/mm)	**Approx. Overall Diameter** (mm)
16	2.2	2.4	4.5	7/0.7	49.0
25	2.2	2.6	4.5	7/0.7	52.5
35	2.2	2.6	5.0	7/0.7	57.0
50	2.2	2.6	5.0	7/0.9	62.0
70	2.2	3.0	5.7	7/0.9	68.5
95	2.4	3.0	6.4	7/0.9	75.5
120	2.4	3.5	6.4	7/0.9	80.5
150	2.4	3.5	7.1	7/1.25	88.0
185	2.4	4.0	7.1	7/1.25	93.5

Table 18 Cable Type 6PA1

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**No./Nominal Diameter of Wires in Steel Strand** (No/mm)	**Approx. Overall Diameter** (mm)
16	3.0	2.6	5.0	7/0.7	54.5
25	3.0	2.6	5.0	7/0.7	58.0
35	3.0	2.6	5.0	7/0.9	62.0
50	3.0	3.0	5.7	7/0.9	68.5

Table 18 (*Concluded*)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**No./Nominal Diameter of Wires in Steel Strand** (No/mm)	**Approx. Overall Diameter** (mm)
70	3.0	3.0	5.7	7/0.9	73.0
95	3.0	3.5	6.4	7/0.9	79.5
120	3.0	3.5	7.1	7/1.25	87.0
150	3.0	4.0	7.1	7/1.25	92.5
185	3.0	4.0	7.8	7/1.25	98.0

Table 19 Cable Type 3FTS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth [#] (mm)	**Nominal Thickness of Outer sheath** (mm)	**Approx. Overall Diameter** (mm)
16	2.2	5.6	41.5
25	2.2	5.6	45.0
35	2.2	5.6	48.0
50	2.2	6.4	53.5
70	2.2	6.4	59.5
95	2.4	7.2	66.0
120	2.4	7.2	70.5
150	2.4	8.1	77.5
185	2.4	8.1	83.0

[#] The diameter of earth core shall be built up equal to nominal diameter of screened power core.

Table 20 Cable Type 6FTS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Thickness of Insulation** Power/ Earth [#] (mm)	**Nominal Thickness of Outer sheath** (mm)	**Approx. Overall Diameter** (mm)
16	3.0	5.6	45.5
25	3.0	5.6	49.0
35	3.0	6.4	53.5
50	3.0	6.4	58.0
70	3.0	7.2	65.0
95	3.0	7.2	69.0
120	3.0	8.1	75.5
150	3.0	8.1	80.5
185	3.0	9.0	87.5

[#] The diameter of earth core shall be built up equal to nominal diameter of screened power core.

Table 21 Cable Type 3FTCS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth[#] (mm²)	**Nominal Insulation Thickness of Power Core** (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**Approx. Overall Diameter** (mm)
16	2.2	2.2	4.5	42.0
25	2.2	2.4	4.5	45.5
35	2.2	2.6	4.5	49.0
50	2.2	2.6	5.0	54.5
70	2.2	3.0	5.0	59.5
95	2.4	3.0	5.7	66.0
120	2.4	3.5	6.4	72.5
150	2.4	3.5	6.4	76.5
185	2.4	3.5	6.4	81.0

[#] Earth core shall be build up equal to diameter of power core.

Table 22 Cable Type 6FTCS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth[#] (mm²)	**Nominal Insulation Thickness of Power Core** (mm)	**Thickness of Sheath** Inner (Min.) (mm)	Outer (Nom.) (mm)	**Approx. Overall Diameter** (mm)
16	3.0	2.4	4.5	46.5
25	3.0	2.6	4.5	50.0
35	3.0	2.6	5.0	54.5
50	3.0	2.6	5.0	58.5
70	3.0	3.0	5.7	65.0
95	3.0	3.0	5.7	69.0
120	3.0	3.5	6.4	75.5
150	3.0	3.5	6.4	80.0
185	3.0	4.0	7.1	86.5

[#] Earth core shall be build up equal to diameter of power core.

Table 23 Cable Type 3FTINS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm²)	**Nominal Insulation Thickness of Power Core** (mm)	**Nominal Thickness of Outer Sheath** (mm)	**Approx. Overall Diameter** (mm)
16	2.2	5.6	41.0
25	2.2	5.6	44.0
35	2.2	5.6	47.0
50	2.2	6.4	53.0
70	2.2	6.4	57.0
95	2.4	7.2	64.0

Table 23 (*Concluded*)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Insulation Thickness of Power Core** (mm)	**Nominal Thickness of Outer Sheath** (mm)	**Approx. Overall Diameter** (mm)
120	2.4	7.2	67.5
150	2.4	8.1	74.0
185	2.4	8.1	78.5

NOTES

1 The diameter of earth core shall be built up equal to nominal diameter of screened power core.

2 Approx. thickness of semi-conducting screen shall be 1.0 mm.

3 Cable shall comply with the requirements of Electrical test on semi-conducting non- metallic screen as per Annex E.

Table 24 Cable Type 6FTINS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nominal Insulation Thickness of Power Core** (mm)	**Nominal Thickness of Outer Sheath** (mm)	**Approx. Overall Diameter** (mm)
16	3.0	5.6	45.0
25	3.0	5.6	48.0
35	3.0	6.4	53.0
50	3.0	6.4	57.0
70	3.0	7.2	62.5
95	3.0	7.2	67.0
120	3.0	8.1	72.5
150	3.0	8.1	77.0
185	3.0	9.0	83.0

NOTES

1 The diameter of earth core shall be built up equal to nominal diameter of screened power core.

2 Approx. thickness of semi-conducting screen shall be 1.0 mm.

3 Cable shall comply with the requirements of Electrical test on semi-conducting non- metallic screen as per Annex E.

Table 25 Cable Type 11FTINS

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	**Nom Insulation Thickness of Power Core** (mm)	**Nominal Thickness of Outer Sheath** (mm)	**Approx. Overall Diameter** (mm)
25	4.0	6.4	58.5
35	4.0	7.2	63.5
50	4.0	7.2	67.5
70	4.0	8.1	73.5
95	4.0	8.1	77.5
120	4.0	8.1	81.5
150	4.0	9.0	88.0
185	4.0	9.0	92.0

NOTES

1 The diameter of earth core shall be built up equal to nominal diameter of screened power core.

2 Cable shall comply with the requirements of electrical test on semi-conducting non- metallic screen as per Annex E.

Table 26 Cable Type 3FTINS/3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	Nominal Insulation Thickness of Power Core (mm)	Nominal Thickness of Outer Sheath (mm)	Approx. Overall Diameter (mm)
16	2.2	5.2	37.0
25	2.2	5.6	40.5
35	2.2	5.6	43.5
50	2.2	5.6	47.0
70	2.2	6.4	52.5
95	2.4	6.4	57.0
120	2.4	7.2	62.0
150	2.4	7.2	66.0
185	2.4	7.2	70.0

NOTES

1 Approx. thickness of semi-conducting screen shall be 1.0 mm.

2 Cable shall comply with the requirements of electrical test on semi-conducting non- metallic screen as per Annex E.

Table 27 Cable Type 6FTINS/3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	Nominal Insulation Thickness of Power Core (mm)	Nominal Thickness of Outer Sheath (mm)	Approx. Overall Diameter (mm)
16	3.0	5.6	41.5
25	3.0	5.6	44.0
35	3.0	5.6	47.0
50	3.0	6.4	52.5
70	3.0	6.4	56.0
95	3.0	7.2	61.5
120	3.0	7.2	65.0
150	3.0	7.2	68.5
185	3.0	8.1	74.5

NOTES

1 Approx. thickness of semi-conducting screen shall be 1.0 mm.

2 Cable shall comply with the requirements of electrical test on semi-conducting non- metallic screen as per Annex E.

Table 28 Cable Type 11FTINS/3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power /Earth (mm^2)	Nominal Insulation Thickness of Power Core (mm)	Nominal Thickness of Outer Sheath (mm)	Approx. Overall Diameter (mm)
25	4.0	6.4	54.0
35	4.0	6.4	56.5
50	4.0	6.4	60.5
70	4.0	7.2	65.5
95	4.0	7.2	69.5
120	4.0	8.1	74.5
150	4.0	8.1	78.5
185	4.0	9.0	84.5

NOTE — Cable shall comply with the requirements of electrical test on semi-conducting non-metallic screen as per Annex E.

Table 29 Cable Type 11LL

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power (mm^2)	Nominal Area of Conductor Earth (mm^2)	Nominal Insulation Thickness of Power Core (mm)	Nominal Thickness of Outer Sheath (mm)	Approx. Overall Diameter (mm)
25	16	4.0	7.2	61.0
35	16	4.0	7.2	64.0
50	25	4.0	7.2	68.0
70	35	4.0	8.1	74.0
95	50	4.0	8.1	78.0
120	70	4.0	9.0	84.0
150	70	4.0	9.0	88.5
185	95	4.0	9.9	94.5

NOTE — The diameter of earth core shall be built up equal to nominal diameter of screened power core.

Table 30 Cable Type 11LL/3

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor Power (mm^2)	Nominal Area of Conductor Earth (mm^2)	Nominal Insulation Thickness of Power Core (mm)	Nominal Thickness of Outer Sheath (mm)	Approx. Overall Diameter (mm)
25	16/3	4.0	6.4	54.0
35	16/3	4.0	6.4	57.0
50	25/3	4.0	7.2	62.5
70	35/3	4.0	7.2	66.0
95	50/3	4.0	8.1	71.5
120	70/3	4.0	8.1	75.0
150	70/3	4.0	8.1	79.0
185	95/3	4.0	9.0	85.0

Table 31 Cable Type 3PA1(S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor		Nominal Thickness of Insulation of Power Core	Thickness of Sheath		No./Nominal Diameter of Wires in Steel Strand	Approx. Overall Diameter
Power	Earth		Inner (Min.)	Outer (Nom.)		
(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(No/mm)	(mm)
16	16	2.2	2.6	5.0	7/0.7	49.5
25	16	2.2	2.6	5.0	7/0.9	54.0
35	16	2.2	2.6	5.0	7/0.9	57.0
50	25	2.2	3.0	5.7	7/0.9	63.5
70	35	2.2	3.0	5.7	7/0.9	69.5
95	50	2.4	3.5	6.4	7/1.25	79.0
120	70	2.4	3.5	7.1	7/1.25	85.0

NOTE — The diameter of earth core shall be built up equal to nominal diameter of screened power core.

Table 32 Cable Type 6PA1(S)

(*Clause* 25.1, *Table* 1)

Nominal Area of Conductor		**Nominal Thickness of Insulation of Power Core**	**Thickness of Sheath**		**No./Nominal Diameter of Wires in Steel Strand**	**Approx. Overall Diameter**
Power	Earth	Inner (Min.)	Outer (Nom.)	Outer (Nom.)		
(mm^2)	(mm^2)	(mm)	(mm)	(mm)	(No/mm)	(mm)
16	16	3.0	2.6	5.0	7/0.9	55.0
25	16	3.0	2.6	5.0	7/0.9	58.0
35	16	3.0	3.0	5.7	7/0.9	63.5
50	25	3.0	3.0	5.7	7/0.9	67.5
70	35	3.0	3.5	6.4	7/0.9	76.0
95	50	3.0	3.5	7.1	7/1.25	83.5
120	70	3.0	4.0	7.1	7/1.25	89.5

NOTE — The diameter of earth core shall be built up equal to nominal diameter of screened power core.

SECTION 4 TESTS

26 CLASSIFICATION OF TESTS

26.1 Type Tests

The tests detailed in Table 33 shall constitute the type tests.

26.1.1 Tests specified at Sl No. g) to m) in Table 33 are applicable only for cables of voltage category 6.35/11 kV.

26.2 In case of 6.35/11 kV cables following tests shall be performed successively on the same sample of completed cable of not less than 10 metres in length between test accessories except for the special provisions.

a) Bending test followed by partial discharge test;
b) Dielectric power factor test;
c) Heating cycle test followed by partial discharge test;
d) Impulse voltage test; and
e) High voltage test for 4 h.

26.3 Special Provisions

a) Dielectric Power factor test may be carried out on different sample.
b) A new sample may be taken for 4 h high voltage test, provided the sample is previously subjected to tests a) and c) listed in **26.2**.

26.4 Acceptance Tests

The following tests shall constitute the acceptance tests:

a) Annealing test;
b) Conductor resistance test;
c) Test for thickness of insulation and sheath;
d) Tensile strength and elongation at break of insulation and sheath;
e) Hot set test for insulation and sheath;
f) Partial discharge test (for 6.35/11 kV cables only) on full drum length;
g) High voltage test; and
h) Electrical test on semi-conducting screen (only for non-metallic screened cable).

A recommended sampling plan for acceptance test is given in Annex F.

26.5 Routine Tests

The following shall constitute routine tests and shall be carried out on full drum length of completed cable.

a) Conductor resistance test;
b) Partial discharge test (for 6.35/11 kV cables only); and
c) High voltage test.

27 DETAILS OF TESTS

27.1 General

Unless specified otherwise in this standard, the tests shall be carried out as per relevant part of IS 10810 taking into consideration any additional requirement, if given, in this standard**.**

27.2 Partial Discharge Test

The magnitude of partial discharge at test voltage 1.73 U_o shall not exceed 10 pC under routine and acceptance tests and 5 pC under type tests.

Table 33 Summary of Type Tests

(*Clause* 26.1)

Sl No.	Tests	Requirements, Ref to IS No./ Clauses of this Standard	Method of Test, Ref to Part of IS 10810
a)	**Test on conductor**		
i)	Annealing test	IS 8130	Part 1
ii)	Conductor resistance test	IS 8130	Part 5
b)	**Dimensions, as applicable**		
i)	Thickness of insulation	**16.2** and Res. Table	Part 6
ii)	Thickness of inner sheath	**22.2** and Res. Table	Part 6
iii)	Diameter of armour wire	Res. Table and IS 3975	Part 36
iv)	Thickness of outer sheath	**24.2** and Res. Table	Part 6
c)	**Tests for armour wires**		
i)	Tensile strength and elongation at break	**11.2**	Part 37
ii)	Torsion test	**11.2**	Part 38
iii)	Uniformity of zinc coating	**11.2**	Part 40
iv)	Mass of zinc coating	**11.2**	Part 41
v)	Resistivity of steel wire	IS 3975	Part 42
d)	**Physical tests on insulation**		
i)	Tensile strength and elongation at break	IS 6380	Part 7
ii)	Ageing in air oven	IS 6380	Part 11
iii)	Ageing in air bomb	IS 6380	Part 56
iv)	Hot set test	IS 6380	Part 30
v)	Ozone resistance test (Not applicable for 1.1 kV)	IS 6380	Part 13
e)	**Physical tests on sheath**		
i)	Tensile strength and elongation at break	IS 6380	Part 7
ii)	Ageing in air bomb	IS 6380	Part 56
iii)	Hot set test	IS 6380	Part 30
iv)	Oil resistance test	IS 6380	Part 31
v)	Tear resistance test for type SE4 only	IS 6380	Part 17
f)	Insulation resistance test	IS 6380	Part 43
g)	Bending test	**27.3**	Part 50
h)	Partial discharge test	**27.2**	Part 46
j)	Dielectric power factor (tan δ measurement) test	**27.4**	Part 48
k)	Heating cycle test	**27.5**	Part 49
m)	Impulse voltage test	**27.6**	Part 47
n)	High voltage test for 4 h	**27.7**	Part 45
p)	Water absorption	IS 6380 and **27.9**	Part 28
q)	Flammability test	**27.8**	Part 53
r)	Electrical test on semi-conducting screen (only for non-metallic screened cable)	Annex E	Annex E of this Standard

27.3 Bending Test

The diameter of test cylinder shall be 8D ± 5 percent, where, D is the overall diameter of the completed cable. After bending operations, the test sample shall be subjected to a partial discharge test and shall comply with the requirement given in **27.2**.

27.4 Dielectric Power Factor (Tan δ Measurement) Test (as a function of temperature)

The sample of completed cable shall be heated until the conductor temperature reaches a temperature 95°C to 100C. The tan δ shall be measured with an alternating voltage of at least 2 kV at this temperature. The measured value shall not exceed 0.04.

27.5 Heating Cycle Test

The sample which, has been subjected to the previous tests, shall be laid on the floor of the test room and heated by passing a current through the conductor, until the conductor reaches a steady temperature 95°C to 100°C. The heating cycle shall be of at least 8 h duration. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h of each heating period. This shall be followed by at least 3 h natural cooling in air to a conductor temperature within 10 K of ambient temperature.

This cycle shall be carried out 20 times. After the last cycle, the sample shall be subjected to a partial discharge test and shall comply with the requirement given in **27.2**.

27.6 Impulse Voltage Test

Impulse voltage test shall be performed on sample at a conductor temperature 95°C to 100°C. Each core of cable shall withstand without failure 10 positive and 10 negative voltage impulses of 75 kV_{peak}.

27.7 High Voltage Test

27.7.1 *Type/Acceptance Test*

This test shall be made at ambient temperature. A power frequency voltage as specified below shall be applied for 4 h to the sample between conductor(s) and metallic screen/armour.

For cables having no metallic screen/armour, the cores of cable sample shall be immersed in water at ambient temperature for at least one hour before the test and voltage shall be applied between the conductor and the water.

The voltage shall be increased gradually to the specified value. No break down of the insulation shall occur.

Voltage grade of cable, kV	1.1	3.3	3.8/6.6	6.35/11
ac voltage between conductor(s) and metallic screen/armour/water, kV	2.4	7.2	14.4	24

27.7.2 *Routine Test*

The cable shall withstand without break down, a power frequency ac voltage as specified below for 5 min between conductor(s) and metallic screen/armour. The voltage shall be increased gradually to the full value.

For cables having no metallic screen/armour, the voltage shall be applied between each insulated conductor and all the other conductors and collective metallic screen, if any.

Voltage Grade of Cable kV	*a.c. Voltage between Conductor(s) and Metallic Screen/Armour* kV
1.1	3.5
3.3	10
3.8/6.6	13.3
6.35/11	21

27.8 Flammability Test

Period of burning after removal of the flame shall not exceed 60 s and the unaffected portion from the lower edge of the top clamp shall be at least 50 mm.

27.9 Water Absorption Test

The test sample of the insulated conductors shall be taken after vulcanisation and prior to the application of any covering except that which may have been applied before vulcanisation. Such coverings shall be removed before the test is made.

This test is not applicable for cables having:

a) Non-conductive separator between the conductor and insulation, or

b) Nominal insulation thickness is less than 1.2 mm, or

c) Insulation having covering which cannot be removed without damaging the insulation.

SECTION 5 IDENTIFICATION, PACKING AND MARKING

28 IDENTIFICATION

Manufacturer's name and/or Trade name, year of manufacture, and voltage grade and type of cable shall be identified throughout the length of the cable either by printing on the outer sheath of cable or by use of printed tape(s) provided inside the cable.

29 PACKING AND MARKING

29.1 The cable shall be wound on a wooden drum (*see* IS 10418), or steel drum and packed. The ends of the cable shall be sealed by means of non-hygroscopic sealing material.

29.2 The drum shall carry the following information stencilled either on the drum or identified by label attached to it.

a) Reference to this Indian Standard;
b) Manufacturer's name or trademark;
c) Type of cable and voltage grade;
d) Number of core;
e) Nominal cross sectional area of conductor;
f) Length of cable on the drum;
g) Number of lengths on the drum (If more than one);
h) Direction of rotation of drum (by means of an arrow);
j) Approximate gross mass of drum;
k) Country of manufacture; and
m) Year of manufacture.

30 BIS CERTIFICATION MARKING

The cable may be marked with the Standard Mark as approved by the BIS.

30.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made there under. The details of the conditions under which the licence for use of the Standard Mark may be granted to the manufacturer or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

LIST OF INDIAN STANDARDS ADJUNCT TO THIS STANDARD

IS Number	*Title*
1885 (Part 32) : 1993	Electro technical vocabulary: Part 32 Electric cable
3975 : 1999	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables
4826 : 1979	Hot dipper galvanized coatings on round steel wires
4905 : 1968	Methods for random sampling
6380 : 1984	Elastomeric insulation and sheath of electric cables
8130 : 2013	Conductors for insulated electric cables and flexible cords
10418: 1982	Drums for electric cables
10810	Method of test for cables
(Part 1) : 1984	Annealing test for wires used as conductor
(Part 5) : 1984	Conductor resistance test
(Part 6) : 1984	Thickness of thermoplastic and elastomeric insulation and sheath
(Part 7) : 1984	Tensile strength and elongation at break of thermoplastic and elastomeric insulation and sheath
(Part 11) : 1984	Thermal ageing in air
(Part 13) : 1984	Ozone resistance test
(Part 17) : 1986	Tear resistance test for heavy sheath
(Part 28) : 1984	Water absorption test (electrical)
(Part 30) : 1984	Hot set test
(Part 31) : 1984	Oil resistance test
(Part 36) : 1984	Dimensions of armouring material
(Part 37) : 1984	Tensile strength and elongation at break of armouring materials
(Part 38) : 1984	Torsion test on galvanized steel wires for armouring
(Part 40) : 1984	Uniformity of zinc coating on steel armour
(Part 41) : 1984	Mass of zinc coating on steel armour
(Part 42) : 1984	Resistivity test of armour wires and strips and conductance test of armour (wire/strip)
(Part 43) : 1984	Insulation resistance test
(Part 45) : 1984	High voltage test
(Part 46) : 1984	Partial discharge test
(Part 47) : 1984	Impulse test
(Part 48) : 1984	Dielectric power factor
(Part 49) : 1984	Heating cycle test
(Part 50) : 1984	Bending test
(Part 53) : 1984	Flammability test
(Part 56) : 1984	Accelerated ageing test by air pressure method

ANNEX B

(*Clause* 25.1)

FICTITIOUS CALCULATION METHOD FOR DETERMINATION OF DIMENSIONS OF PROTECTIVE COVERINGS

The thickness of cable coverings, such as sheaths and armour, has usually been related to nominal cable diameters by means of “step-tables”.

This sometimes causes problems. The calculated nominal diameters are not necessarily the same as the actual values achieved in production. In borderline cases, queries can arise if the thickness of a covering does not correspond to the actual diameter because the calculated diameter is slightly different. Variations in shaped conductor dimensions between manufacturers and different methods of calculation cause difference in nominal diameters and may therefore lead to variations in the thickness of covering used on the same basic design of cable.

To avoid these difficulties, the fictitious calculation method shall be used. The idea is to ignore the shape and degree of compaction of conductors and to calculate fictitious diameters from formulae based on the cross sectional area of conductors, nominal insulation thickness and number of cores. Thickness of sheath and other coverings are then related to the fictitious diameters by formulae or by tables. The method of calculating fictitious diameter is precisely specified and there is no ambiguity about the thickness of coverings to be used, which are independent of slight differences in manufacturing practices. This standardizes cable designs, thicknesses being pre-calculated and specified for each conductor cross-section.

The fictitious calculation is used only to determine dimensions of sheaths and cable coverings. It is not a replacement for the calculation of actual diameters required for practical purposes, which shall be calculated separately.

B-1 GENERAL

The following fictitious method of calculating thicknesses of various covering in a cable has been adopted to ensure that any differences which can arise in independent calculations, for example due to assumption of conductor dimensions and the unavoidable differences between nominal and actually achieved diameters, are eliminated.

All thickness values and diameters shall be rounded according to rules in Annex C to the first decimal figure.

Tapes/strips, if not thicker than 0.3 mm, are neglected in this calculation method.

B-2 METHOD

B-2.1 Conductors

The fictitious diameter (d_L) of a conductor, irrespective of conductor configuration, is given for each nominal cross-section in Table 34.

B-2.2 Core

B-2.2.1 *Unscreened Cores*

The fictitious diameter D_c of an unscreened core is given by:

$$D_c = d_L + 2\,t_i$$

B -2.2.2 *Screened Cores*

The fictitious diameter D_c of a screened core is given by:

a) For voltage category 1.1 kV, 3.3 kV and 3.8 / 6.6 kV

  1) Metallic screen cores:

$$D_c = d_L + 2\,t_i + 3.0 \text{ mm}$$

  2) Non-metallic, that is, semi-conducting screened cores:

$$D_c = d_L + 2\,t_i + 3.0 \text{ mm}$$

Table 34 Fictitious Diameter of Conductor

(*Clause* B-2.1)

Nominal Cross Sectional Area of Conductor	d_L	Nominal Cross Sectional Area of Conductor	d_L	Nominal Cross Sectional Area of Conductor	d_L
mm²	mm	mm²	mm	mm²	mm
4	2.6	35	8.5	150	18.0
6	3.6	50	10.3	185	20.0
10	4.6	70	12.4	240	23.0
16	5.7	95	14.5	300	26.0
25	7.1	120	16.0		

b) For voltage category 6.35/11 kV

   1) Metallic screened cores:

$$D_c = d_L + 2\,t_i + 6.0 \text{ mm}$$

   2) Non-metallic, that is semi-conducting screened cores:

$$D_c = d_L + 2\,t_i + 4.5 \text{ mm}$$

where, t_i is the nominal thickness of insulation, in mm.

B-2.3 Laid-up Cores

The fictitious diameter over laid up cores (D_f) is given by:

a) Cables without cradle separator:

$$D_f = K \text{ x } D_c$$

b) Cables with cradle separator:

$$D_f = K \text{ x } (D_c + 1.8) - 1.8 \text{ mm}$$

where,

K is the assembly coefficient as given below:

Number of Insulated Cores	*Assembly Coefficient, K*
2	2.0
3	2.16
4	2.42
5	2.7

B-2.4 Inner Sheaths

The fictitious diameter over inner sheath (D_s) is given by:

$$D_s = D_u + 2\,t_s$$

where,

D_u is the fictitious diameter under the inner sheath, in mm; and

t_s is thickness of inner sheath, in mm.

B-2.5 Armour

The fictitious diameter over the armour (D_x) is given by:

$$D_x = D_{UA} + 2\,t_A$$

where,

D_{UA} is the fictitious diameter under the armour, in mm; and

t_A is the diameter of armour strand, that is, 3 times the diameter of individual armour wire, in mm.

B-2.6 Collective Metallic Screen

The fictitious diameter over the collective metallic screen (D_m) is given by:

$$D_m = D_{UM} + 3.0$$

where,

D_{UM} is the fictitious diameter under the collective metallic screen, in mm.

ANNEX C

(*Clause* 25.1)

ROUNDING OF NUMBERS

C-1 ROUNDING OF NUMBERS FOR THE PURPOSE OF THE FICTITIOUS CALCULATION METHOD

The following rules apply when rounding numbers in calculating fictitious diameters and determining dimensions of component layers in accordance with Annex B.

When the calculated value at any stage has more than one decimal place, the value shall be rounded to one decimal place, that is, to nearest 0.1 mm. The fictitious diameter at each stage shall be rounded to 0.1 mm and, when used to determine the thickness or dimension of an overlying layer, it shall be rounded before being used in the appropriate formula or table. The thickness calculated from the rounded value of the fictitious diameter shall, in turn be rounded to 0.1 mm as required in Annex B

To illustrate these rules, the following practical examples are given:

a) When the figure in the second decimal place before rounding is 0, 1, 2, 3 or 4, then the figure retained in the first decimal place remains unchanged (rounding down);

   Examples:

   2.12 ≈ 2.1

   2.449 ≈ 2.4

   25.0478 ≈ 25.0

b) When the figure in the second decimal place before rounding is 9, 8, 7, 6, or 5, then the figure in the first decimal place is increased by one (rounding up).

   Examples:

   2.17 ≈ 2.2

   2.453 ≈ 2.5

   30.050 ≈ 30.1

C-2 ROUNDING OF NUMBERS FOR OTHER PURPOSES

For purposes other than those considered under **C-1**, it may be required that values are rounded to more than one decimal place. This may occur, for instance, in calculating the average value of several measurement results or the minimum value by applying a percentage tolerance to a given nominal value. In these cases, rounding shall be carried out to the number of decimal places specified in the relevant clauses.

The method of rounding shall then be as follows:

a) If the last figure to be retained is followed, before rounding, by 0, 1,2, 3 or 4, it shall remain unchanged (rounding down); and
b) If the last figure to be retained is followed, before rounding, by 9, 8, 7, 6 or 5, it shall be increased by one (rounding up).

   Examples:

2.449	≈	2.45	Rounded to two decimal places
2.449	≈	2.4	Rounded to one decimal place
25.0478	≈	25.048	Rounded to three decimal places
25.0478	≈	25.05	Rounded to two decimal places
25.0478	≈	25.0	Rounded to one decimal place

ANNEX D

(*Clause* 25.1)

GUIDING TABLES FOR DETERMINING THICKNESS OF INNER/OUTER SHEATH AND PLIABLE ARMOUR

Table 35 Thickness of Inner and Outer Sheath for Cables Without Collective Metallic Screen and Pliable wire Armour

Fictitious Diameter Under Inner Sheath as Per Annex B		**Thickness of Inner Sheath**	**Thickness of Outer Sheath**
Above (mm) (1)	Up to and including (mm) (2)	Minimum (mm) (3)	Nominal (mm) (4)
—	10	1.4	2.0
10	15	1.6	2.4
15	20	1.8	2.6
20	25	2.0	2.8
25	30	2.2	3.0
30	40	2.4	3.2
40	50	2.8	3.6
50	60	3.2	4.0
60	70	3.6	4.5
70	80	4.0	5.0
80	—	4.4	5.5

NOTE — A unified sheath equal to sum of thickness of inner and outer sheath has been considered in the respective tables

Table 36 Thickness of Inner sheath for Cables with Collective Metallic Screen and Pliable wire Armour

Fictitious Diameter Under Inner Sheath as Per Annex B		**Thickness of Inner Sheath**
Above (mm) (1)	Up to and including (mm) (2)	Minimum (mm) (3)
—	10	1.6
10	15	1.8
15	20	2.0
20	25	2.2
25	30	2.4
30	40	2.6
40	50	3.0
50	60	3.5
60	70	4.0
70	80	4.5
80	90	5.0
90	100	5.5
100	—	6.0

Table 37 Thickness of Outer Sheath for Cables with Collective Metallic Screen and Pliable Wire Armour

Fictitious Diameter Under Outer Sheath as Per Annex B		**Thickness of Outer Sheath**
Above (mm) (1)	Up to and Including (mm) (2)	Nominal (mm) (3)
—	10	2.5
10	15	2.8
15	20	3.2
20	25	3.6
25	30	4.0
30	40	4.5
40	50	5.0
50	60	5.7
60	70	6.4
70	80	7.1
80	90	7.8
90	100	8.5
100	—	9.0

Table 38 Dimensions of Pliable Wire Armour

Fictitious Diameter Under Armour as per Annex B		**Size of Armour Strand**
Above (mm) (1)	Up to and Including (mm) (2)	No./Nominal Wire Diameter (mm) (3)
—	25	7/0.45
25	40	7/0.70
40	60	7/0.90
60	—	7/1.25

ANNEX E

(*Clause* 17.4, *Table* 23 *to Table* 28 and *Table* 33)

ELECTRICAL TEST ON SEMI-CONDUCTING NON-METALLIC CORE SCREEN WHERE PROVIDED IN PLACE OF METALLIC CORE SCREEN FOR POWER CORES

E-1 A sample of cable shall be taken at least 300 mm from the end of factory length and a test voltage of 70 V a.c. at frequency 40 to 60 Hz, with a series resistance of 225 Ω connected to the test circuit, shall be applied between a power conductor and the earth conductor.

E-2 A fault shall be created by means of approximately 0.9 mm bare steel needle pushed through the outer sheath of the cable, through the conducting elastomeric screen and into the power conductor. The leakage current shall be recorded and shall reach a value of not less than 125 mA within 10 ms from the instant the needle makes contact with the power conductor and shall not fall below 125 mA within 200 ms from that instant. Alternatively, the needle may be inserted before the test voltage is applied in which case the time interval and current flow are determined from the instant the voltage is switched on.

E-3 If the flow of current from any one core does not comply with the requirements specified under **E-2**, two further test on each of the three cores shall be carried out at approximately 150 mm and 300 mm respectively from the point of original measurement. If each of these additional tests produces a current flow that complies with requirements of **E-2**, the cable shall be deemed to have satisfied the requirements.

ANNEX F

(*Clause* 26.4.1)

SAMPLING OF CABLES

F-1 LOT

In any consignment the cables of the same size manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

F-2 SCALE OF SAMPLING

F-2.1 Samples shall be taken and tested from each lot for ascertaining the conformity of the lot to the requirements of the specification.

F-2.2 The number of samples to be selected shall be as given below:

Number of Drums in the Lot (1)	*Number of Drums to be Selected for Testing* (2)	*Permissible Number of Defectives* (3)
Up to 25	3	0
26 to 50	5	0
51 to 100	8	0
101 to 300	13	1
301 and above	20	1

These samples shall be taken at random. In order to ensure the randomness of selection, procedure given in IS 4905 may be followed.

F-3 NUMBER OF TESTS AND CRITERION FOR CONFORMITY

From each of the drums selected, suitable lengths of test samples shall be taken. These test samples shall be subjected to each of the acceptance tests (*see* **26.2**). A test sample is called defective if it fails in any one of the acceptance tests. If the number of defectives is less than or equal to the corresponding permissible number given in col 3 under **F-2.2**, the lot shall be declared as conforming to the requirements of acceptance tests, otherwise not.

ANNEX G

(*Informative*)

APPLICATION OF CABLES

FT1	Intrinsic safe cable in U/G production system requiring infrequent movement — 3 phase
FT2	Intrinsic safe cable in U/G production system requiring infrequent movement — 3 phase and earth
FT3	Cable for mobile production machines in U/G application
FT4(S)	Cable for production — cum-transportation machines in U/G application — Crawler mounted requiring medium degree of movement.
FT6(S)	Cable for mobile production machines in U/G application
FT7	Heavy duty trailing cable for mobile production machines in U/G application with multipurpose built-in attachments like intermediate crusher, steel-tray conveyor etc. for example road headers.
FT7(S)	Heavy duty trailing cable for mobile production machines in U/G applications with remote control/annunciation requirements for example, sophisticated road headers, shearers in multipurpose packages etc. suitable for use as interconnecting cables also.
FT8	Heavy duty trailing cable for mobile production machines in U/G application and surface use material handling application to satisfy space limitation, for example, Auger-cum drill, Paddle feeders, Stacker/ Re-claimers etc.
FT10	Trailing cable for wheel mounted production support machines calling for heavy reeling duty requirement in U/G mines for example LHD's, Low height SDL's etc.
FTD3	Cable for hand-held drill machines
FTD3(S)	Cable for hand-held drills with intrinsic safety requirements
P3	Power feeder to transportation/ ventilation system in U/G mines
PLC2 to PLC5	Cable for lighting and auxiliary circuits in U/G application.
PA3	Cable for single phase/ DC application
PA1, 3PA1, 6PA1	Cable requiring infrequent movements in OCM zone prone to cause external injury by thrust.
3FTS, 6FTS	OCM trailing cable for machines requiring medium degree of movements, for example, Excavators.
3FTCS, 6FTCS	OCM trailing cable reeling duty, for example, BH drills, Excavators with CRD
3FTINS, 6FTINS, 11FTINS	Trailing cable for heavy reeling duty OCM and material handling applications requiring high torsion strength
3FTINS/3, 6FTINS/3, 11FTINS/3	Trailing cable with space limitation in CRD, for example, BWRE's, Stacker/ Re-claimers
11LL, 11LL/3	Hazardous duty mine power feeder in OCM, for example, landline

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